

Armed Forces College of Medicine

AFCM



Cranial Nerve Nuclei

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INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1. Recognize the term columns of cranial nerves nuclei.
2. Identify the arrangement of motor & sensory columns within the brain stem.
3. Give a note on the type (functional component) and distribution of nerve fibers in each column.
4. List the cranial nerves nuclei belonging to each column.

Lecture Plan



1. Part 1 (5 min) Introduction
2. Part 2 (40 min) Main lecture
3. Part 3 (5 min) Summary

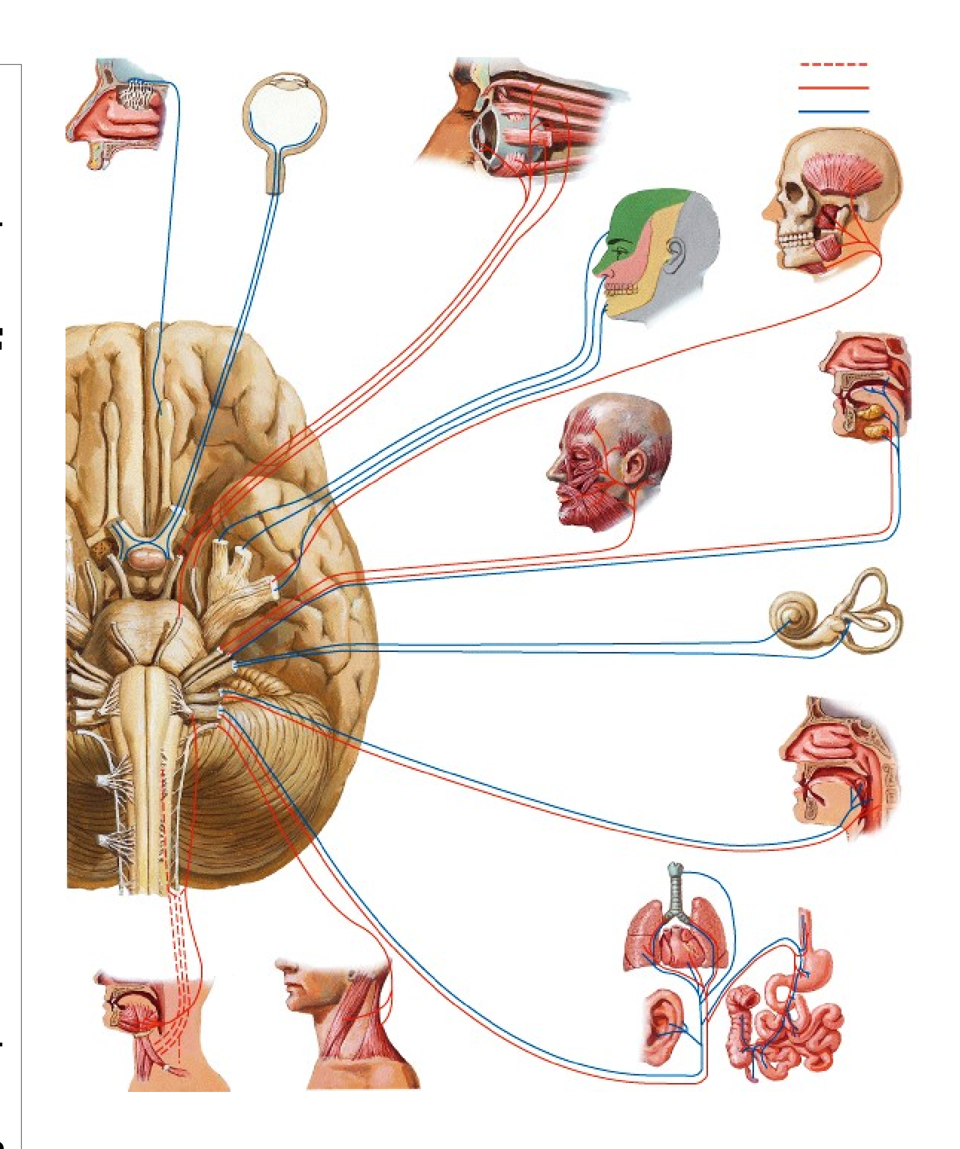
Key points



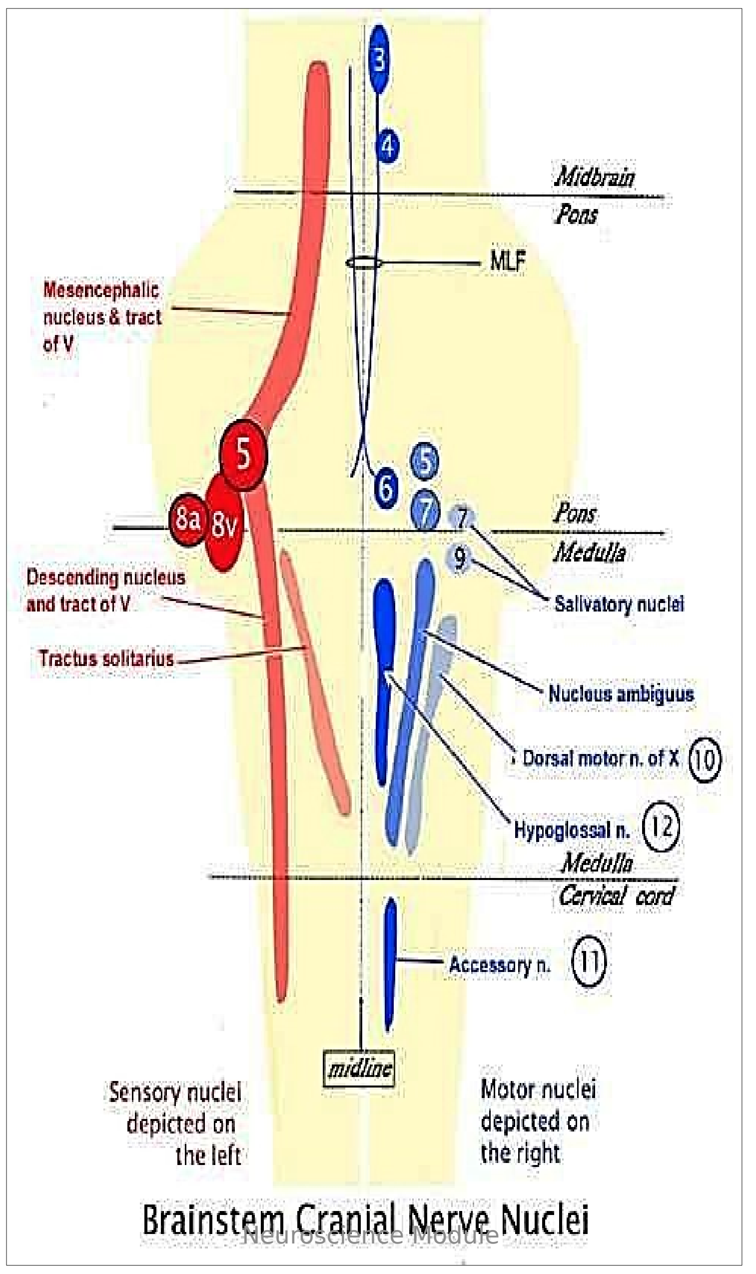
1. What is meant by columns of cranial nerves nuclei?
2. The 3 motor columns; their functional components & nuclei
3. The 4 sensory columns; their functional components & nuclei
4. In summary & important notes

♣**Cranial nerves**:

- **There are <u>12 pairs</u> of cranial nerves.**
- **All have nuclei of origin in brain stem <u>EXCEPT</u> olfactory & optic Ns.**
- **Their nuclei are in form of columns in the brain stem.**
- **The columns include <u>3 motor</u> columns medially & <u>4 sensory</u> columns laterally *on each side***



Columns of cranial nerves nuclei



Motor columns:

1.**Somatic efferent column**:

SE [General somatic efferent GSE]

-It is motor to skeletal muscles that develop from myotomes i.e. it is somatomotor.

-It includes :

1. Nucleus of III oculomotor in the midbrain at level of superior colliculus, supply all extraocular muscles except superior oblique and lateral rectus

2. Nucleus of IV trochlear in the midbrain at level of inferior colliculus supply superior oblique(SO4)

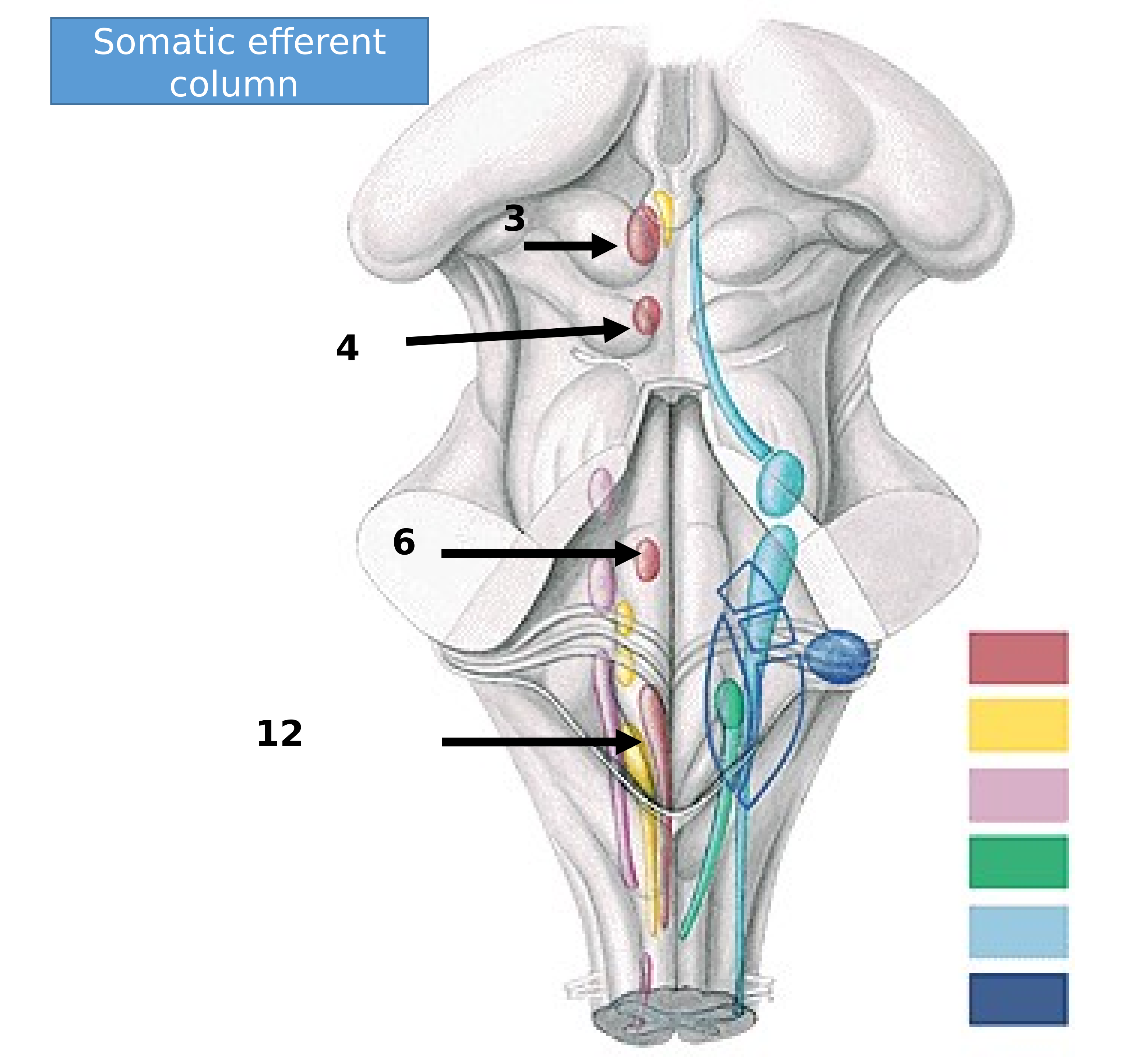
3. Nucleus of VI abducent in pons deep to medial eminence in floor of forth ventricle supply Lateral rectus

4. Nucleus of XII hypoglossal

- ✓ **in medulla oblongata (inferior fovea) supply tongue muscles except platoglossus**
- ✓ **part that supplies genioglossus receives contralateral cortico-nuclear fibers**

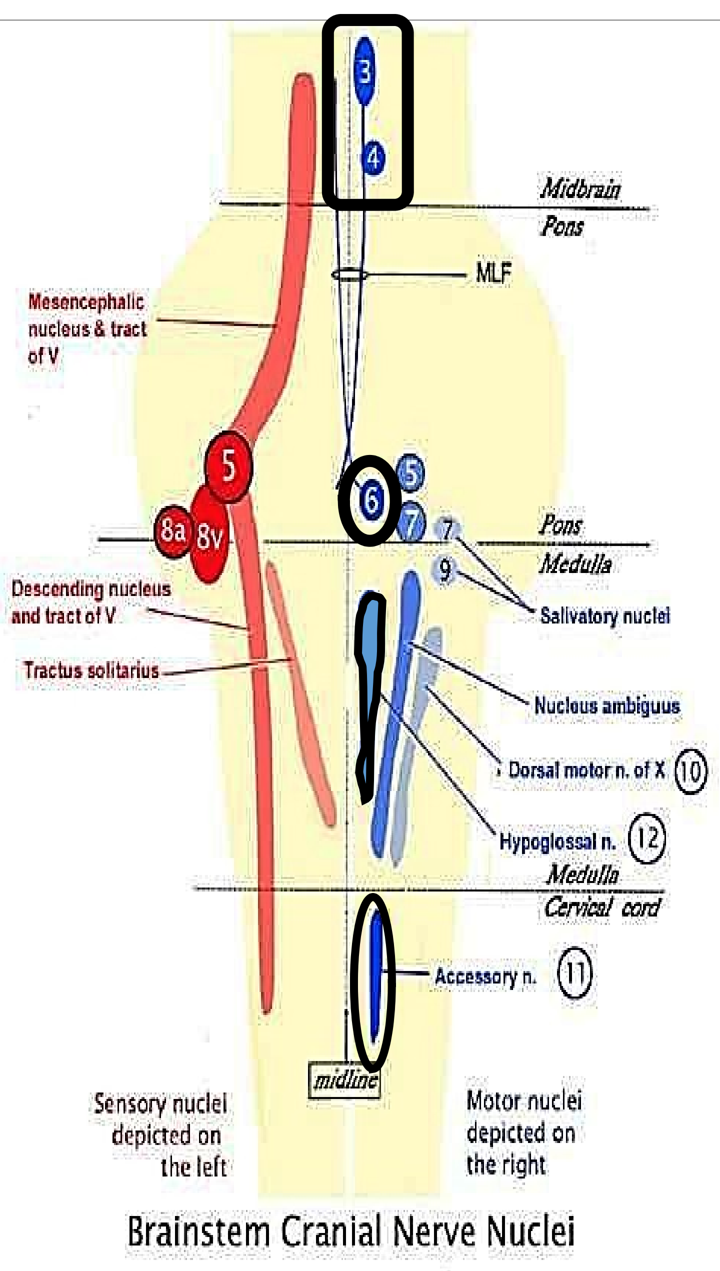
5. Spinal accessory nucleus of XI in upper 5 cervical segments of spinal cord for.................................

Somatic efferent column



SE column of CN nuclei

Hypothalamus
Optic nerve (II)
Mammillary bodies
Optic tract
Oculomotor nerve (III) and nucleus
3
Trochlear nerve (IV) and nucleus
4
Basilar pons
Mesencephalic nucleus (V)
Trigeminal nerve (V) motor root
Trigeminal nerve (V) sensory root
Motor nucleus (V)
Main sensory nucleus (V)
Abducens nerve (VI) and nucleus
Facial nerve (VII)
Facial nerve (VII) nucleus
6
Vestibulocochlear nerve (VIII)
Vestibular nuclei
Glossopharyngeal nerve (IX)
Nucleus ambiguus (IX and X)
Vagus nerve (X)
12
Hypoglossal nerve (XII)
Dorsal motor nucleus (X)
Hypoglossal nucleus (XII)
Spinal accessory nerve (XI)
11
Solitary nucleus
Spinal nucleus and tract (CN V)



Special visceral efferent column: SVE

It is motor to skeletal muscles that develop from the visceral (branchial or pharyngeal) arches i.e. it is branchiomotor.

1. Motor nucleus of trigeminal in pons supplies muscles of the 1st arch muscles of mastication , mylohyoid and anterior belly of digastric tensor tympani and tensor palati

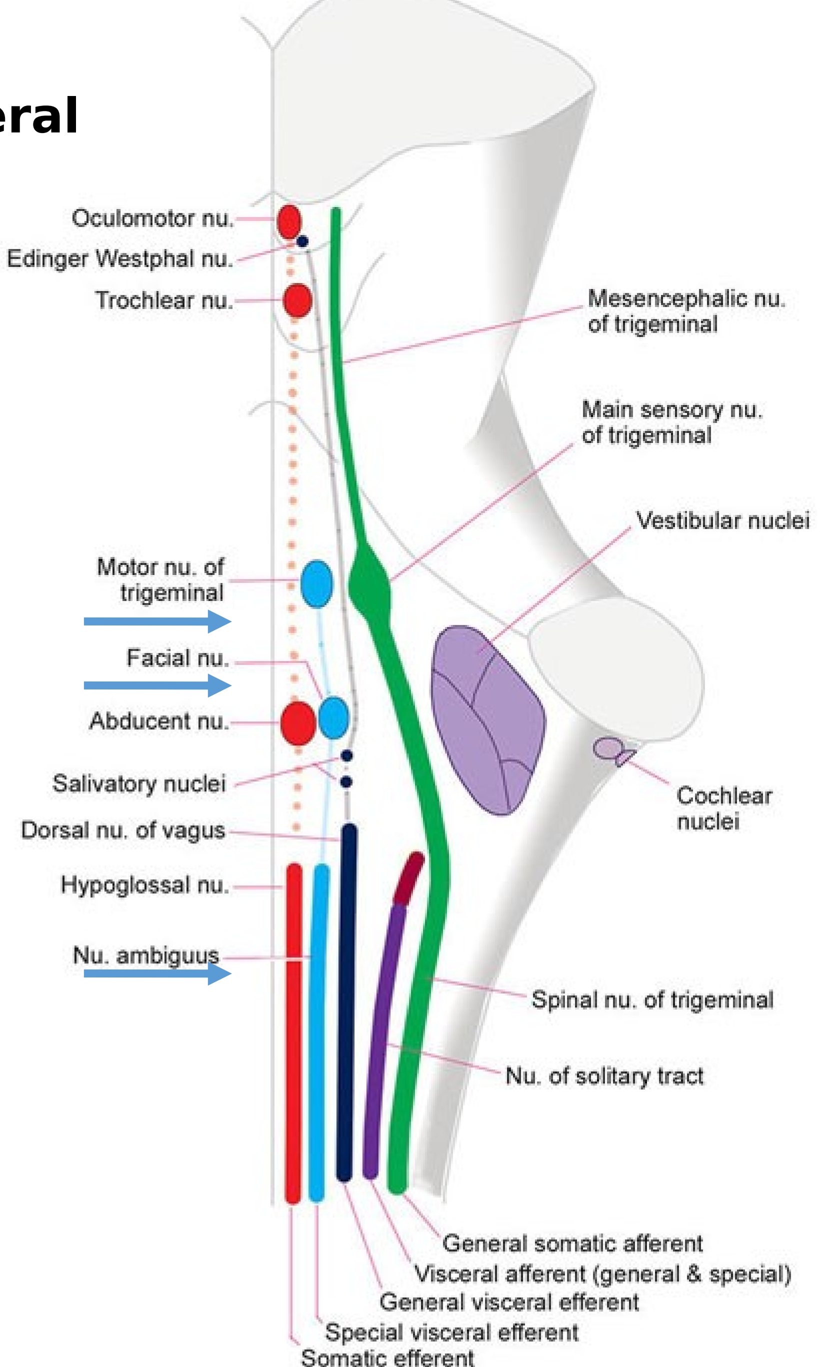
2. Motor nucleus of facial

- ✓ in pons supplies muscles that develop from the 2nd arch, facial muscles, posterior belly of digastric, stylohyoid and stapedius .
- ✓ Fibers of nucleus makes a loop around abducent nucleus called.................................
- ✓ Part that supplies muscles of lower part of face receives contralateral corticonuclear

3. Nucleus Ambiguus in medulla oblongata shared by 3 cranial nerves , supply fibers to:

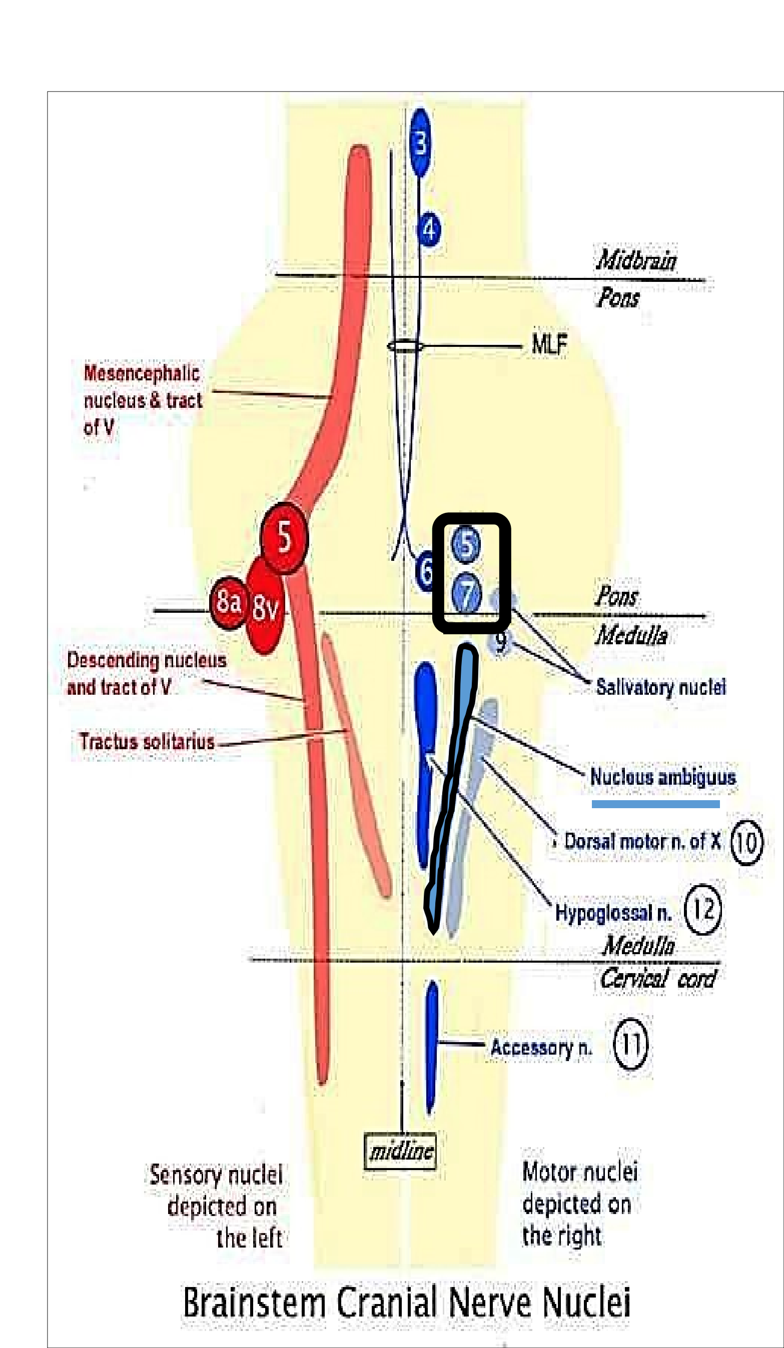
- ✓ glossopharyngeal supplying muscle of 3rd arch: Stylopharyngeus from upper part of nucleus.
- ✓ Vagus & cranial accessory from middle and lower supplying muscles that develop from the 4th & 6th arches:

Special visceral efferent



Waheeb

E column of CN nuclei

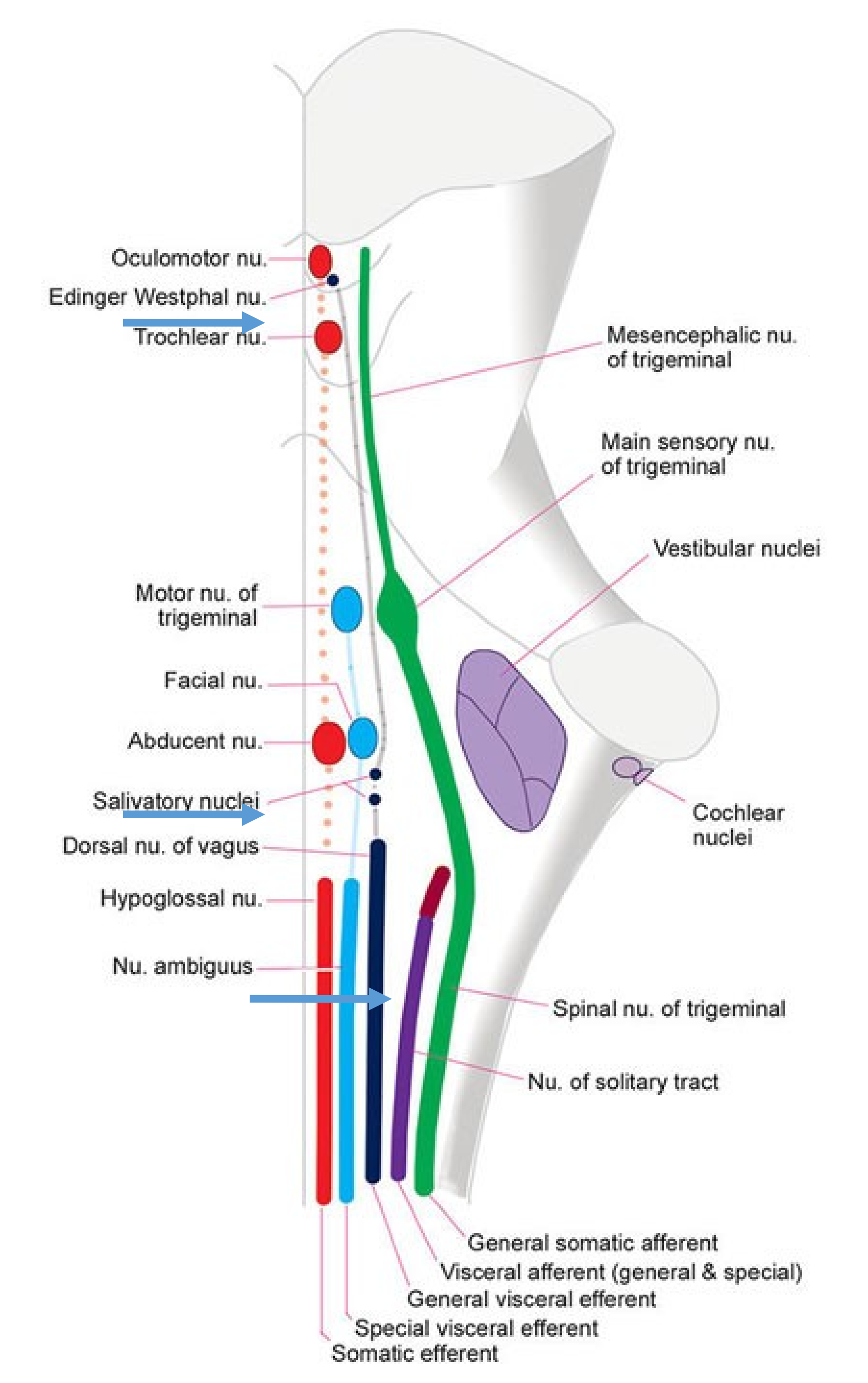


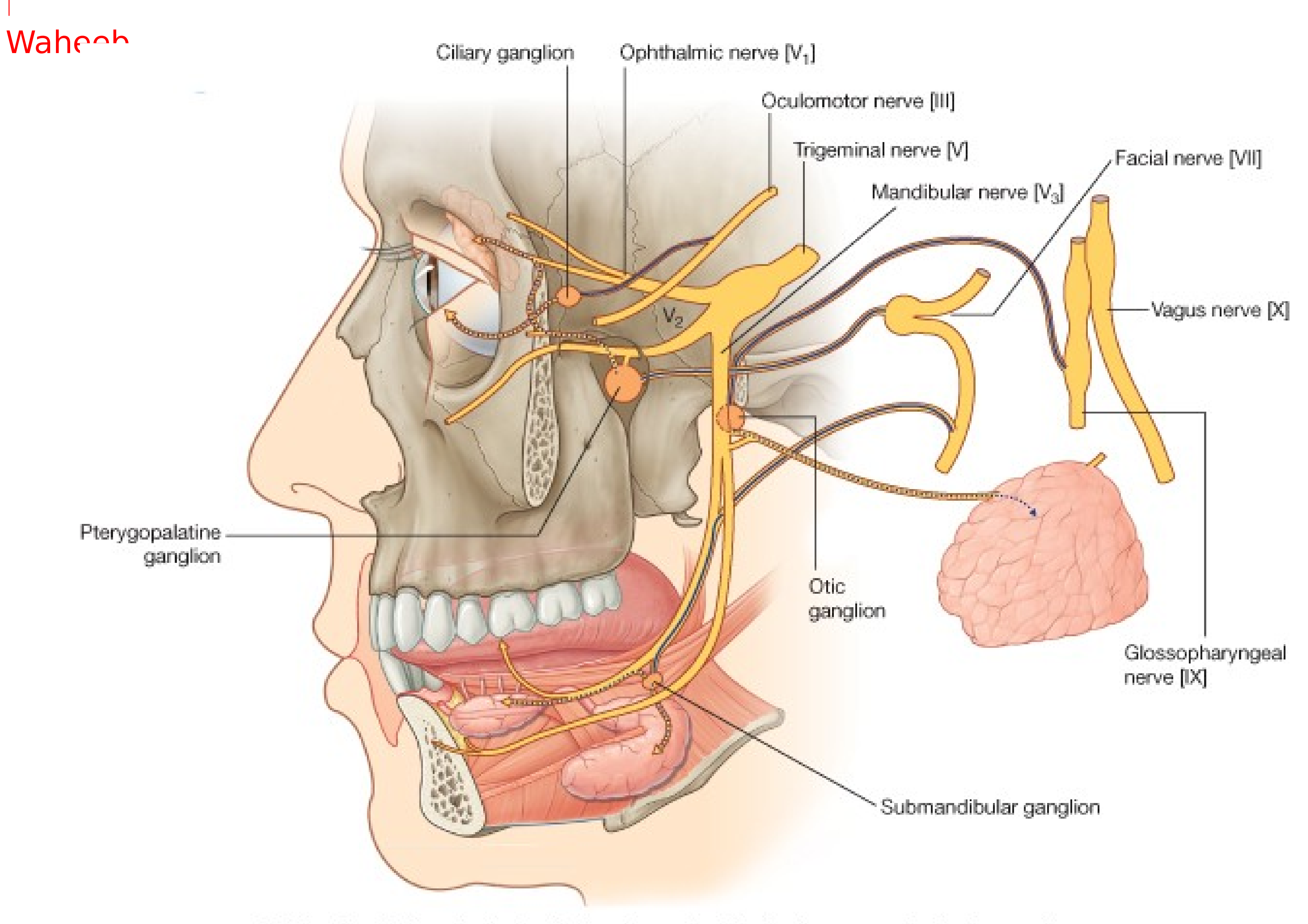
3. General visceral efferent column: GVE

-it gives preganglionic parasympathetic fibers to the 4 parasympathetic ganglia in head & neck.

- **Edinger Westphal nucleus of (III) (in midbrain): Supplies ciliary muscle & sphincter pupillae muscle *via ciliary ganglion and oculomotor nerve* .**
- **Nuclei of fascial nerve:**
  - **.Superior salivatory nucleus ⇒ Submandibular & sublingual salivary glands via *submandibular ganglion and chorda tympani nerve* .**
  - **.Special lacrimatory nucleus ⇒ Lacrimal gland *via pterygopalatine ganglion and greater petrosal* .**
  - **.Uncertain nucleus ⇒ Glands in pharynx,**

General visceral efferent

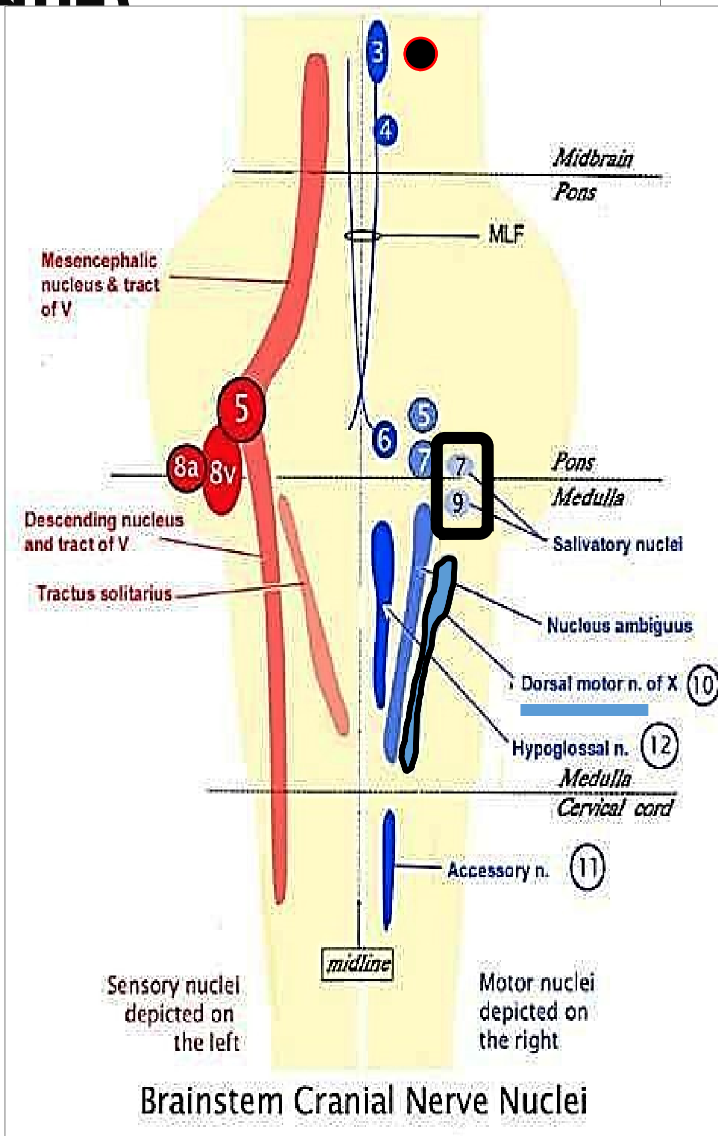



Ciliary ganglion
Ophthalmic nerve [V1]
Oculomotor nerve [III]
Trigeminal nerve [V]
Mandibular nerve [V3]
Facial nerve [VII]
V2
Vagus nerve [X]
Pterygopalatine ganglion
Otic ganglion
Glossopharyngeal nerve [IX]
Submandibular ganglion

Waheeb

4. Dorsal vagal nucleus of (X): Gives parasympathetic fibers to CVS, bronchial tree & most of GIT (foregut & midgut)

Hypothalamus
Optic nerve (II)
Mammillary bodies
Optic tract
Oculomotor nerve (III) and nucleus
3
Basilar pons
Trochlear nerve (IV) and nucleus
Mesencephalic nucleus (V)
Trigeminal nerve (V) motor root
Trigeminal nerve (V) sensory root
Motor nucleus (V)
Main sensory nucleus (V)
Abducens nerve (VI) and nucleus
Facial nerve (VII)
Facial nerve (VII) nucleus
7
Vestibulocochlear nerve (VIII)
Vestibular nuclei
9
Glossopharyngeal nerve (IX)
Nucleus ambiguus (IX and X)
10
Vagus nerve (X)
Hypoglossal nerve (XII)
Dorsal motor nucleus (X)
Hypoglossal nucleus (XII)
Spinal accessory nerve (XI)
Solitary nucleus
Spinal nucleus and tract (CN V)



B]Sensory columns: *4 Functional components*

1.General visceral afferent column: GVA

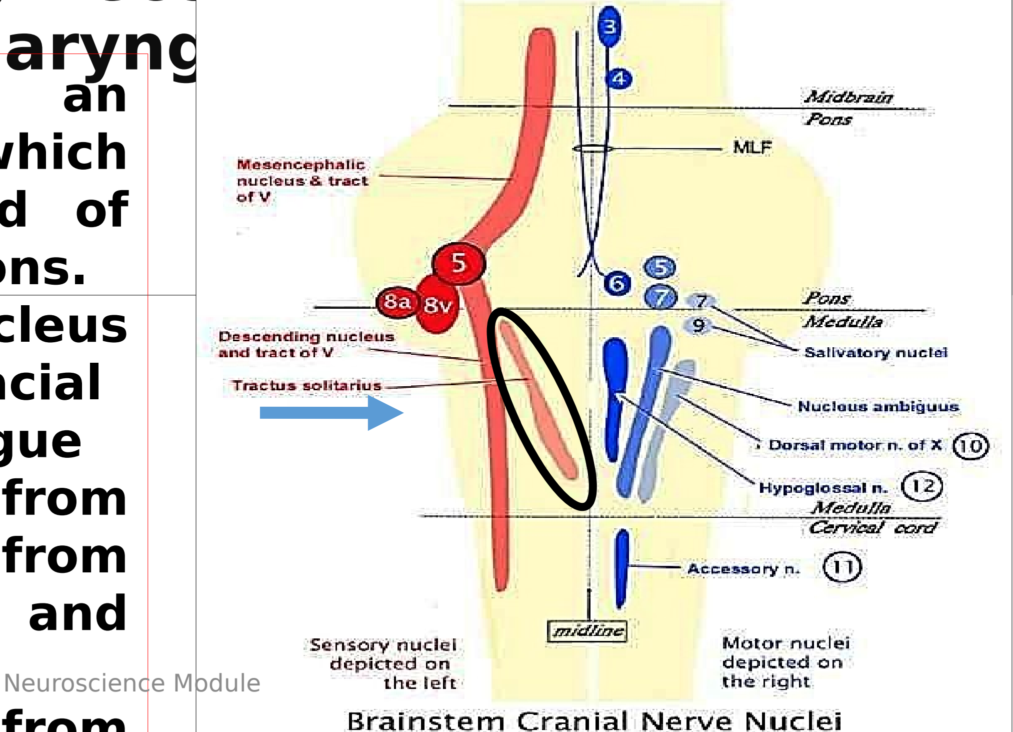
-Nucleus solitarius, receives general sensations from the viscera *mainly supplied by vagus*

2.Special visceral afferent column: SVA

-Nucleus solitarius, receives taste sensation via facial , glossopharyng

Nucleus solitarius is an elongated nucleus which extends from caudal end of Medulla to lower part of pons.

- **Upper part of nucleus receives fibers from facial from anterior 2l3 of tongue**
- **Middle part receive from glossopharyngeal from posterior one third and circumvallate papillae**
- **Lower part receives from**



3.General somatic afferent column: GSA

-Main sensory nucleus of V: Crude touch & pressure from head.

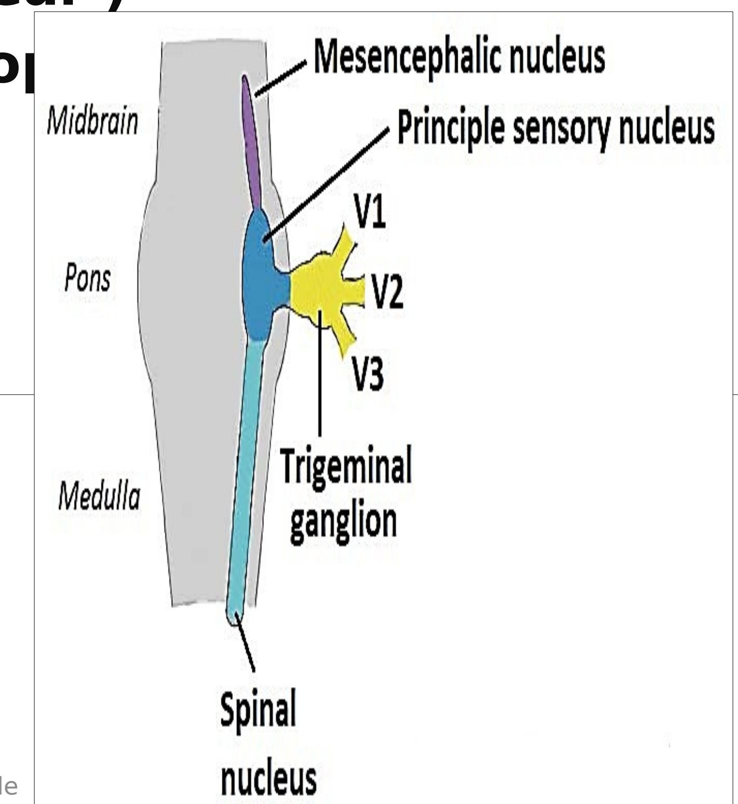
.Spinal nucleus of V: Pain & temperature from head. It also receives GSA from facial (concha of ear) and glossopharyngeal (from posterior one third of tongue , oropharynx, tonsils and middle ear)

.Mesencephalic nucleus of V: Prop

Sensory nuclei of trigeminal N.:

1.Main sensory nucleus: In pons lateral to motor nucleus.

2.Spinal nucleus: An elongated nucleus in M.O. & upper 2 cervical segments of spinal cord



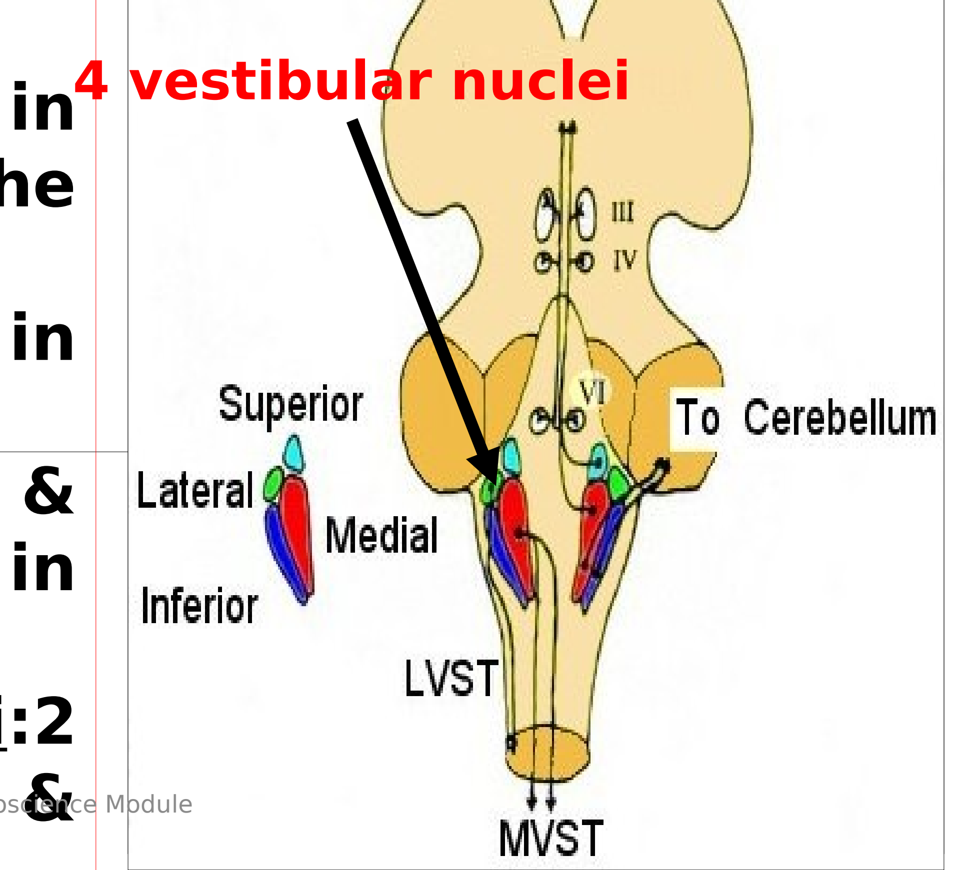
4. Special somatic afferent column: SSA

-Cochlear & vestibular nuclei of VIII CN.

Vestibular nuclei:
4 nuclei lie in vestibular area in the floor of 4th ventricle.

- ✓ Superior nucleus in pons.
- ✓ Medial, lateral & inferior nuclei in Medulla.

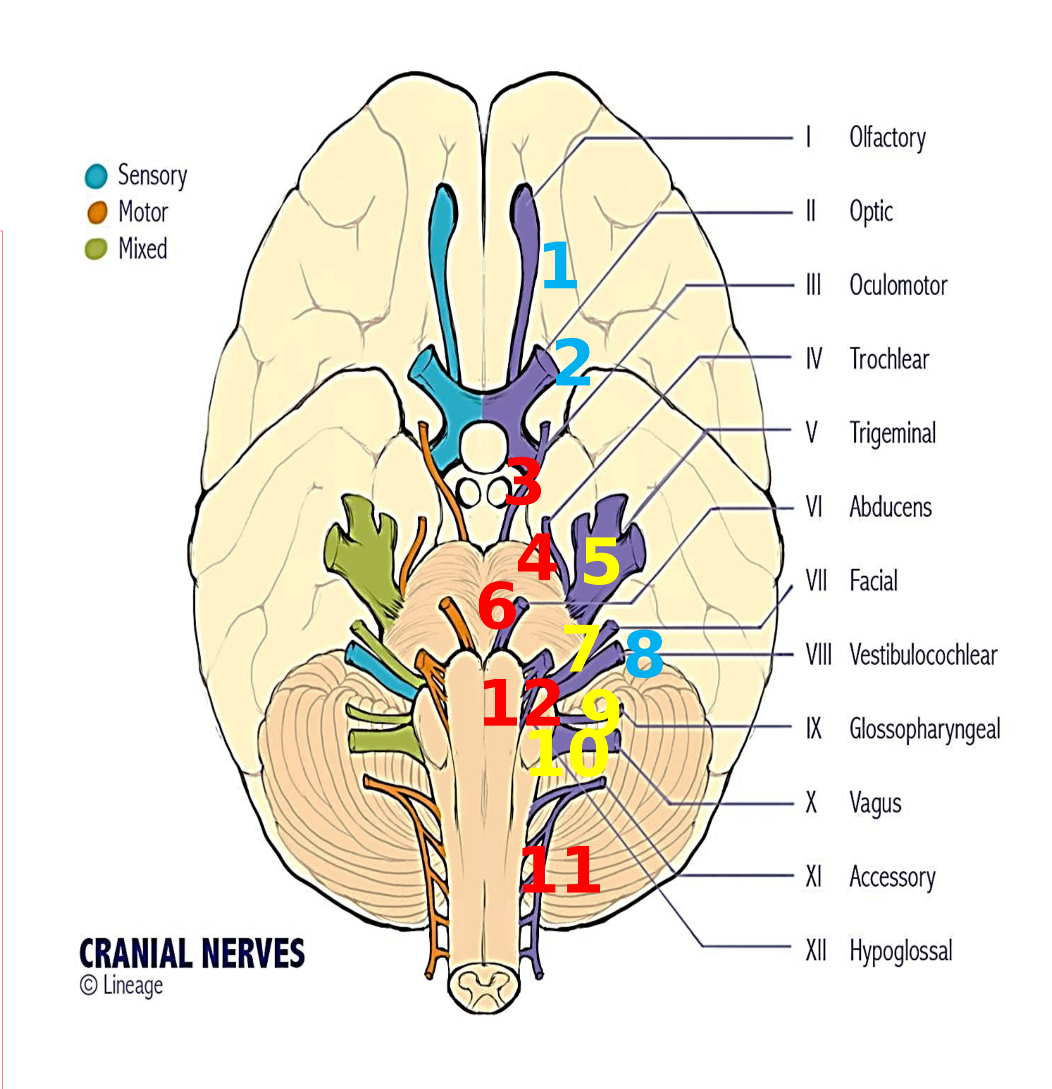
Cochlear nuclei: 2 nuclei (ventral & dorsal) in pons



3 cranial nerves are *purely sensory* (I, II & VIII). ***128***

5 cranial nerves are *purely motor* (III, IV, VI, XI & XII). ***SE***

4 cranial nerves are *mixed* (V,



REMEMBER

- **All motor nu[illegible] of cranial nerves receive <u>bilateral</u> corti[illegible]nuclear tracts <u>EXCEPT</u> part of *<u>Facial nucleus</u>* that innervates muscles of lower part of face & the part of *<u>Hypoglossal</u>* nucleus that innervates genioglossus muscle.**

-These two nuclei receive *<u>contralateral cortico-nuclear fibers o</u>*nly so are liable to an UMNL.

- **Nucleus *Ambiguus* is shared by 3 CNs: IX, X, XI. *<u>SVE</u>***
- **Nucleus *Solitarius* is shared by 3 CNs: VII, IX, X. *<u>SVA</u> [IX & X also carry <u>GVA</u>]. 197***
- ***Spinal nucleus of trigeminal* is shared by 4 CNs that carry general somatic sensation: V, VII, IX, X. *<u>GSA</u> 1975***

SUGGESTED TEXTBOOKS



1. **Richard S. Snell, clinical neuroanatomy; 7th edition.**
2. **Web sites: https://studentconsult.inkling.com**
   https://www.clinicalkey.com/student

